

CLAIMS

I claim:

1. On a plurality of IP networks, each of said plurality of networks being remote from every other network, each said network being connected to the internet by a VPN-router, a method of sending an IP packet from a host on one of said plurality of networks to a host on another of said plurality of networks, comprising the steps of:
 - a. assigning a netID to each network of said plurality of networks;
 - b. assigning an IP address to each host on each said network, said IP address for each said host having the same netID as the network to which said host is attached, each said host having a hostID that is unique to said host's network;
 - c. for each said network, assigning a virtual IP address to said network representing a host on a remote network, said virtual IP address having the same netID as said network and a hostID that is unique to said network;
 - d. creating in each said VPN-router connected to each said network, one or more tables cross referencing each virtual IP address on said network to the netID of the remote network of the host which said virtual IP address represents, and cross referencing each host attached to said network to each virtual remote IP address representing said host on each remote network;
 - e. sending an IP packet from a host on one of said plurality of networks to a host on another of said plurality of networks, said IP packet.
2. A method of sending an IP packet as claimed in claim 1 wherein one of said networks is a home network and the remaining networks in said plurality of networks are remote

1 networks, said IP addresses and said virtual IP addresses assigned to said home network
2 being taken from a range of reserved private IP addresses, said range being one of three
3 blocks of IP addresses, a first block comprising contiguous IP addresses from 10.0.0.0
4 and extending through 10.255.255.255, a second block comprising contiguous IP
5 addresses from 172.16.0.0 and extending through 172.16.255.255, and a third block
6 comprising contiguous the IP addresses from 192.168.0.0 and extending through
7 192.168.255.255.

8
9 3. A method of sending an IP packet as claimed in claim 2 wherein IP addresses and virtual
10 IP addresses assigned to said remote networks are taken from the same said range of
11 reserved private IP addresses as said IP addresses and virtual IP addresses assigned to
12 said home network.

13
14 4. A method of sending an IP packet as claimed in claim 1 wherein said IP packet is sent
15 from a first host attached to a first network in said plurality of networks, said first host
16 having an IP address on said first network, to a second host attached to a second network
17 in said plurality of networks, said second host having an IP address on said second
18 network, said first and second networks being attached to the internet and being remote
19 from each other, comprising the further steps of:

20 a. said first host sending an IP packet to a first VPN-router connecting said first
21 network to the internet, said IP packet having a header that includes a destination
22 IP address and a source IP address, said destination IP address being a virtual IP

- 1 address assigned to said first network representing said second host, and said
2 source IP address being said IP address of said first host on said first network;
- 3 b. said first VPN-router receiving said IP packet, determining the virtual remote IP
4 address representing said first host upon said second network, replacing said
5 source IP address with said virtual remote IP address representing said first host
6 upon said second network, encapsulating said IP packet as a payload within an
7 encapsulating IP packet, providing said encapsulating IP packet with a destination
8 IP address of a second remote VPN-router connecting said second network to the
9 internet, and sending said encapsulating IP packet to the internet for routing and
10 delivery to said second VPN-router;
- 11 c. said second VPN-router receiving said encapsulating IP packet, decapsulating
12 said encapsulating IP packet to recover said IP packet, determining the IP address
13 of said second host on said second network, replacing said destination IP address
14 of said IP packet with said IP address of said second host on said second network,
15 and sending said IP packet to said second network for delivery to said second
16 host.

- 17
- 18 5. A method of sending an IP packet as claimed in claim 4, further comprising the steps of:
- 19 a. said first host encrypting the payload of said IP packet prior to sending said IP
20 packet to said first VPN-router; and
- 21 b. said second host decrypting said payload of said IP packet upon receiving said IP
22 packet from said second VPN-router.
- 23

- 1 6. A method of sending an IP packet from a first host attached to a first network to a second
2 host attached to a second network, and sending a second IP packet from said second host
3 to said first host, said first and second networks being attached to the internet, comprising
4 the steps of:
- 5 a. assigning a first IP address to said first host attached to said first network, said
6 first IP address comprising a netID and a hostID that is unique to said first
7 network;
 - 8 b. assigning a second and third IP address to a first VPN-router connecting said first
9 network to the internet, said second IP address being assigned to said VPN-
10 router's interface to said first network and having the netID of said first network
11 and a hostID that is unique to said first network, said third IP address being
12 assigned to said first VPN-router's interface with the internet and being a globally
13 unique IP address;
 - 14 c. assigning a fourth IP address as a virtual IP address to represent, on said first
15 network, said second host, said second host being attached to said second network
16 that is attached to the internet and that is remote from said first network, said
17 fourth IP address having the netID of said first network and a hostID that is
18 unique to said first network;
 - 19 d. assigning a fifth IP address to said second host attached to said second network,
20 said fifth IP address having the netID of said second network and a hostID that is
21 unique to said second network;
 - 22 e. assigning a sixth and seventh IP address to a second VPN-router connecting said
23 second network to the internet, said sixth IP address being assigned to said VPN-

1 router's interface to said second network and having the netID of said second
2 network and a hostID that is unique to said second network, said seventh IP
3 address being assigned to said second VPN-router's interface with the internet and
4 being a globally unique IP address;

5 f. assigning an eighth IP address as a virtual IP address to represent, on said second
6 network, said first host, said eighth IP address having the netID of said second
7 network and a hostID that is unique to said second network;

8 g. creating a table in said first VPN-router whereby said fourth IP address is cross
9 referenced to said seventh IP address, and said first IP address is cross referenced
10 to said eighth IP address;

11 h. creating a table in said second VPN-router whereby said eighth IP address is cross
12 referenced to said third IP address, and said fourth IP address is cross referenced
13 to said fifth IP address;

14 i. sending said first IP packet from said first host, said first IP packet having as its
15 destination IP address said fourth IP address and having as its source address said
16 first IP address;

17 j. receiving said first IP packet at said first network interface of said first VPN-
18 router, replacing said source IP address in said first IP packet with said eighth IP
19 address, encapsulating said first IP packet as a payload within a first
20 encapsulating IP packet having as its destination IP address said seventh IP
21 address, and sending said first encapsulating IP packet to the internet for routing
22 to said second VPN-router;

- k. receiving said first encapsulating IP packet at said second VPN-router,
decapsulating said payload to obtain said first IP packet, examining said first IP
packet to determine said first IP packet's destination, replacing said first IP
packet's destination IP address with said fifth IP address, and placing said first IP
packet on said second network for delivery to said second host;
- l. receiving said first IP packet at said second host, and sending a second IP packet
from said second host to said first host.

7. The method of sending a first IP packet from a first host to a second host and sending a
second IP packet from said second host to said first host as claimed in claim 6,
comprising the further steps of:

- l. sending said second IP packet from said second host, said second IP packet
having as its destination IP address said eighth IP address and having as its source
address said fifth IP address;
- m. receiving said second IP packet at said second VPN-router's interface to said
second network, replacing said source address with said fourth IP address,
encapsulating said second IP packet as a payload within a second encapsulating
IP packet having as its destination IP address said third IP address, and sending
said second encapsulating packet to the internet for routing to said first VPN-
router; and
- n. receiving said second encapsulating IP packet at said first VPN-router,
decapsulating said payload to obtain said second IP packet, examining said
second IP packet to determine said second IP packet's destination, replacing said

second IP packet's destination IP address with said first IP address, and placing said second IP packet on said second network for delivery to said first host attached to said first network.

8. A method of sending a plurality of IP packets from one or more hosts attached to a first network to one or more remote hosts attached to one or more networks remote from said first network, said first network and each of said one or more remote networks being connected to the internet by a VPN-router, comprising the steps of:

- a. assigning a netID to said first network and to each network of said one or more remote networks;
- b. assigning an IP address to each host of said one or more hosts attached to said first network and to each remote host attached to each of said one or more remote networks, each said host's IP address having the same netID as the network to which said host is attached, and each said host's IP address having a hostID that is unique to said host's network;
- c. assigning one or more virtual IP addresses to said first network, each said virtual IP address representing one of said one or more remote hosts on said one or more remote networks, each said virtual IP address having the same netID as said first network and a hostID that is unique to said first network;
- d. assigning one or more virtual IP addresses to each of said one or more remote networks, each of said one or more virtual IP addresses representing a host on said first network

- 1 e. creating in said VPN-router connected to said first network, one or more tables
2 cross referencing each virtual IP address on said first network to the netID of the
3 remote network of the host which said virtual IP address represents, and cross
4 referencing each host attached to said first network to each virtual IP address
5 representing each said host on each of said one or more remote networks;
- 6 f. creating in each VPN-router connecting one of said one or more remote networks
7 to the internet one or more tables cross referencing each virtual IP address on said
8 remote network to said first network, and cross referencing the IP address of each
9 remote host on said remote network to the virtual IP address representing said
10 remote host on said first network;
- 11 g. sending a plurality of IP packets from one or more said hosts on said first network
12 to one or more said remote hosts on one or more said remote networks, the
13 destination IP address of each IP packet in said plurality of IP packets being the
14 said virtual IP address on said first network of the said remote host to which the
15 said IP packet is sent, and the source IP address of each said IP packet in said
16 plurality of IP packets being the said local IP address of the said host on said first
17 network from which the said IP packet is sent;
- 18 f. receiving said plurality of IP packets at said first VPN router and, for each said
19 packet, determining the said source IP address of the said host on said first
20 network sending said IP packet and replacing said source IP address with the said
21 virtual IP address representing said sending host on the said remote network to
22 which said IP packet is being sent, determining the remote network of the remote
23 host to which said IP packet is addressed, encapsulating said IP packet as a

1 payload within an encapsulating IP packet, addressing said encapsulating IP
2 packet for delivery to the said remote VPN-router attached to said remote
3 network, and placing said encapsulating IP packet on the internet, such that a
4 plurality of encapsulating IP packets are routed from said first VPN-router to said
5 one or more remote VPN-routers;

- 6 g. for each of said one or more remote VPN-routers attached to one of said one or
7 more remote networks, receiving one or more of said plurality of encapsulating IP
8 packets at said remote VPN-router and, for each of said one or more
9 encapsulating IP packets, decapsulating said encapsulating IP packet to obtain
10 said IP packet, examining said IP packet to determine the said virtual destination
11 IP address, replacing said virtual destination IP address with the IP address of the
12 remote host to which said IP packet is directed on said remote network, and
13 sending said IP packet to said remote network for delivery to said remote host.

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15 9. The method of sending a plurality of IP packets from one or more local hosts
16 attached to a first network to one or more remote hosts attached to one or more
17 remote networks as claimed in claim 8, comprising the further steps of encrypting
18 said one or more IP packets at said first VPN-router prior to encapsulation and
19 transmission to said one or more remote VPN-routers; and decrypting said one or
20 more IP packets at said one or more remote VPN-routers after decapsulation and
21 before transmission to said one or more remote networks.